Ownership matrix	**RPP-27195**

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1.0 PURPOSE AND SCOPE
(7.1.1)

This procedure describes the process for implementing the Tank Operations Contractor (TOC) internal dosimetry program. It describes the process used by the TOC and Radiological Site Services (RSS) to monitor and evaluate TOC and its subcontractor employees for internal exposures. This procedure also addresses specific actions and responsibilities for operating and administering a routine bioassay program. This procedure also provides guidance on writing TOC source term reports, for assigning routine bioassay requirements on Radiological Work Permits (RWPs), performing special evaluations in response to an event or occurrence, and for investigating positive routine bioassay results.

This procedure applies to facility radiological control organizations, RWP preparers, managers who manage radiological workers, and the Radiological Control Program organization.

Internal dosimetry guidance for declared pregnant employees is located in TFC-ESHQ-RP_DOS-C-06.

2.0 IMPLEMENTATION

This procedure is effective on the date shown in the header.

3.0 RESPONSIBILITIES

Responsibilities are contained within Section 4.0.

4.0 PROCEDURE

Sections within this procedure may be performed individually or in parallel, as needed, to accomplish the desired task.

4.1 Routine Bioassay Monitoring

NOTE: Baseline bioassay evaluation of personnel likely to receive intakes resulting in a committed effective dose (CED) greater than 100 mrem in a year shall be conducted before they begin work that may expose them to occupational intakes.

Manager/Facility Radiological Control Organization	1.	Based on the job to be performed and the facility or project source term report, determine the routine bioassay that is appropriate for an employee, or determine whether any changes to an existing bioassay schedule are needed. • A review of routine bioassay schedules for employees performing similar work may help in establishing the appropriate routine bioassay • A review of RWPs that may be used to access radiological areas may help in determining the appropriate bioassay or a change in bioassay

- A baseline and end-of-assignment monitoring may be used instead of routine monitoring for work assignments of limited duration, or when the work period is shorter than the typical routine monitoring interval.

Manager	2.	Complete a Tank Operations Contractor Dosimetry Change Request (A-6004-105) to place the employee on a routine bioassay or to make a change in the routine bioassay. a. Submit the Tank Operations Contractor Dosimetry Change Request to the Internal and External Dosimetry Facility Point of Contact (FPOC) for approval and signature.
Internal and External Dosimetry FPOC	3.	Forward the Tank Operations Contractor Dosimetry Change Request to Dosimetry Operations.

NOTE: The purpose of the review below is to identify employees who are on routine bioassays that may no longer be required for their current work activities or to ensure employees are scheduled for the proper bioassay for their work environment. A list of personnel bioassay schedules is available upon request from Dosimetry Operations.

Internal and External Dosimetry FPOC	4.	Review bioassay schedules annually for employees assigned to your facility, as applicable, and work with managers to update employee bioassay schedules, as necessary.

4.2 Termination Bioassays

NOTE: Termination or end-of-assignment bioassay monitoring is required for any worker who participated in bioassay monitoring.

Manager or Human Resources	1.	Notify Dosimetry Operations or the Internal and External Dosimetry FPOC of employee termination prior to the termination date so that any term counts or kits can be scheduled.
Dosimetry Operations	2.	Contact affected individuals or human resources for scheduled termination bioassays.
Internal Dosimetry Company Technical Authority (CTA)	3.	At least once per year, request WRPS Dosimetry Operations to provide information summarizing the number and percentage of personnel who terminate employment but fail to either report for in vivo bioassay or provide an in vitro bioassay sample.

4.3 Performing Special Evaluations (Special Bioassay)

NOTE: The decision to select any particular contamination level as criterion for initiating special bioassay is highly subjective. As such, the dosimetry program factors in the unique aspects of each occurrence and exercises good judgment in prescribing special bioassays.

Project Radcon Manager/Internal and External Dosimetry (FPOC)

1. Notify the Internal and External Dosimetry Company Technical Authority (CTA) when one of the following levels has been exceeded, or other listed conditions that may indicate the potential for an intake of radioactive material:

   - Spread of contamination that results in levels of radionuclides at or exceeding the levels given in Table 1
   - Loss of containment or exposure control, such as failure of a ventilation system or respiratory protection resulting in exposure to high concentrations of radioactivity in the air
   - Unplanned releases of radioactive material to the environment that may have affected workers
   - Suspected intake of radioactive material with the potential for a CED of 100 mrem
   - Unexpected surface contamination encountered during the course of a job, which may have resulted in high airborne concentrations.

Table 1. Contamination Levels for Triggering a Special Evaluation.

Indicator	Alpha-Emitters, dpm	Beta/Gamma-Emitters, dpm
Nasal or mouth smears	Above background	Above background
Facial contamination (direct)	200	4,000
Skin breaks (direct)	Any skin break while handling alpha-emitters other than sealed sources	Any detectable activity around or on a skin break; or detectable activity on a blood smear
Head, neck contamination (direct)	2,000	40,000
Contamination inside respirator	Detectable activity inside respirator after use.	
Hands, forearms, clothing[a] (direct)	10,000	200,000
Airborne contamination exposure after incorporating respiratory protection factors	Acute exposure ≥40 DAC-hours[b] should undergo special bioassay.	
	Acute or cumulative exposures exceeding 10 DAC-hours in a calendar year should undergo dose assessment: use DAC-hours or special bioassay for dose assessment, as appropriate.	

[a] Clothing contamination levels apply to exposure without respiratory protection, e.g., contamination levels on inner coveralls while undressing

[b] DAC-hours = time-integrated exposure to airborne contamination

Internal and External Dosimetry FPOC/CTA

2. Evaluate the potential for measurable internal exposure based on the contamination levels, the form of material (i.e., liquid or solid, flighty or sticky), the chemical form (i.e., nitrate or oxide), or any other additional information that needs to be included to make this decision.

   a. If no potential for measurable intake exists, document the basis for the decision in the employee's personnel dose history file. No further action is required.

   b. If a special bioassay is requested, continue with step 3.

Internal and External Dosimetry CTA

3. Notify the RSS exposure evaluator and TOC Industrial Hygiene of the event.

4. Ensure the on-call occupational medicine contractor is promptly contacted through the Patrol Operations Center (373-0911) or by other means, if the spread of contamination results in levels of radionuclides at or exceeding the levels given in Table 2.

Table 2. Criteria for Notification of Occupational Medicine On-Call Provider.

Indicator	Alpha-Emitters (dpm)	Beta/Gamma-Emitters (dpm)
Nasal or mouth smears	1,000	100,000
Facial contamination (direct)	25,000	500,000
Skin breaks (direct)	100	20,000

5. Discuss the appropriateness of any dose reduction therapy; consult the recommendations of HNF-55719, Table 7.4.

Internal and External Dosimetry FPOC/CTA

6. Ensure technical smears, personal smears (i.e., nasal, mouth, or blood smears), and field data are retained to support the final dose evaluation.

7. Provide contamination and decontamination information to a RSS exposure evaluator, if the information is available.

RadCon Management or Internal and External Dosimetry CTA

8. Meet, or arrange for a member of Radiological Control management to meet, at the in vivo monitoring facility with all WRPS or subcontractor employees who will be receiving a special whole body count or chest count due to meeting or exceeding the limits contained in Table 1. (7.1.1)

NOTE: In general, a worker restriction is not required if results of in vivo measurements are less than decision level and any necessary in vitro samples have been obtained.

Internal and External Dosimetry CTA

9. Determine the need to restrict the worker from radiological work based on the results of any in vivo measurements and other applicable information from the event. (See Section 4.6.) (7.1.1)

10. Work with RSS exposure evaluator to determine the proper bioassay follow-up actions based on the source term of the facility.

    a. Use data from facility or project source term reports.

    b. Use contamination/decontamination data such as nasal smears and clothing/coverall samples.

    c. Use smear and air sample data collected during the job.

    d. Estimate the activity of contributing radionuclides based on gross counting techniques and gamma and alpha spectroscopy, if available.

    e. Develop radionuclide ratios using field data so that a comparison can be made with the applicable facility source term report.

11. Work with facility personnel, RSS exposure evaluator, and the occupational medicine contractor, as appropriate, to notify the worker of dose evaluation status and final dose.

12. Counsel concerned workers, as necessary.

Internal and External Dosimetry CTA/FPOC

13. Review the initial dose estimate performed by RSS exposure evaluator.

Internal and External Dosimetry CTA

14. Upon receipt from the RSS exposure evaluator, forward the final dose evaluation report to the employee, the employee's supervisor, the appropriate Internal Dosimetry Facility Point of Contact, the facility radiological control manager, and other personnel, as requested. (7.1.1)

    a. In conjunction with the distribution of the final report, ensure that the dose values and any health and safety implications have been discussed with the employee and/or their manager.

15. If the dose evaluation results in an occurrence report, and the employee has not received a copy of the dose evaluation, provide the employee with a report on their exposure data no later than the time that such report is transmitted to the U.S. Department of Energy (DOE). (7.1.1)

4.4 Routine Bioassay Results Above the Oral Reporting Level but Less Than the Screening Level

Internal and External Dosimetry CTA

1. Upon notification from RSS Internal Dosimetry of a bioassay result above oral reporting levels, but less than the screening levels in HNF-55719, Appendix A, perform the following for the affected employee:

   a. For Cs-137, Co-60, and Eu-154, the Whole Body Count nuclides of interest, take no specific action since a normal results letter will automatically be sent to the employee by the RSS's Internal Dosimetry.

   b. For U, Pu, and Am, the Chest Count nuclides of interest, determine the need for a follow-up bioassay based on work history and potential sources of exposure.

      1) Notify the RSS Internal Dosimetry of the decision.

4.5 Investigation of Positive Routine Bioassay Results above the Screening Level

NOTE: Any routine bioassay measurement that exceeds screening levels results in follow-up actions. Initial follow-up actions (i.e., recounts and reanalysis) for indirect bioassays are automatically performed by the RSS Internal Dosimetry. Initial follow-up investigations for in vivo bioassays are typically performed by the Internal and External Dosimetry CTA.

Internal and External Dosimetry CTA

1. Upon notification from the RSS Internal Dosimetry of a bioassay result above screening levels in HNF-55719, Appendix A, review the affected employee's work history and potential sources of exposure.

   a. Review RWP entries, with attention to entries since last in vivo exam or excreta bioassay.

   b. Review bioassay historical results for trends and anomalies.

   c. Review facility characterization data.

   d. Attempt to contact the affected employee to discuss the type of work performed under RWPs, any radiological incidents they may have been involved in, radionuclides encountered in the workplace, and potential non-occupational sources of intake, such as wild game and foodstuffs from Europe, Japan, and Russia, which may be sources of Cs-137 and other radionuclides.

2. Based on work history and potential sources of exposure, determine the need for a follow-up bioassay, and notify RSS Internal Dosimetry of the decision.

a. Consider indirect bioassays (i.e., in vitro bioassay) for Sr-90, plutonium, and other radionuclides, as necessary, unless the work history review indicates no potential for an intake.

b. Forward any supporting data to RSS Internal Dosimetry as it will become part of any dose evaluation package that may be developed.

3. If a formal assessment of internal dose is performed, ensure the employee receives a copy of the final dose evaluation report and counsel the employee, as necessary.

4.6 Contractor Request Bioassays

NOTE: Reasons for the use of a contractor request bioassay may arise from an event that has transpired that did not produce any field indications of a contamination problem, but there is a concern for an intake by a worker. There may be other worker concerns that can be satisfied by a one-time sampling of a worker population.

Internal and External Dosimetry FPOC/CTA

1. If requested by an employee, or if a bioassay is requested by the actionee when an event does not fall into any of the above categories, fill out a Tank Operations Contractor – "Contractor Request" Bioassay form (A-6003-970).

2. If any requested bioassays are positive, follow up as indicated in Section 4.3 or Section 4.4, as appropriate.

4.7 Restricting Radiological Workers
(7.1.1)

NOTE: Work restrictions related to individuals who failed to submit required routine bioassay samples or failed to complete in vivo counts after two attempts are administered by Dosimetry Operations.

Internal Dosimetry Company Technical Authority/Facility Point of Contact

1. Restrict an employee from radiological work for any of the following reasons:

- Measured a high routine in vivo count with a potential to exceed an administrative control level
- Exceeded an administrative control level
- Any other situation that the Internal and External Dosimetry CTA/FPOC has assessed, which could result in undetected internal dose
- Continuous attempts for pending signatures to close out an Investigation of a Dosimeter Result (IODR).

2. Contact WRPS Dosimetry Operations, in writing to place a restriction in the Sentinel Radiological Access Control System (RAC).

3. Notify the project/activity radiological control manager and the Internal and External Dosimetry FPOC of the work restriction.

   a. Provide written notification to the employee and the employee's manager explaining the reason for the restriction, and identify required corrective actions.

   b. Send a copy of the written notification to WRPS dosimetry operations to put in the employee's permanent dosimetry file.

4. Contact WRPS dosimetry operations to remove the work restriction, in writing, when the identified corrective actions have been completed.

4.8 Facility Source Term Reports

NOTE 1: Facility source term reports supply information to support the decisions made in assigning routine bioassay requirements in Radiological Work Permit preparation.

NOTE 2: A facility may be excepted from the annual update to the report if the criteria below are met:

- It can be demonstrated that the facility has been adequately characterized
- Based on an appropriate review, the source term has not changed since the last report sufficiently to change the ratios used for bioassay assignment
- The source term review and request for the exception is documented in a memo to the Internal Dosimetry Company Technical Authority
- Concurrence is demonstrated by the signature of the Internal and External Dosimetry CTA on the memo, and the memo is issued in accordance with TFC-BSM-AD-C-03.

Internal and External Dosimetry FPOC

1. Review and update the facility source term report by December 31 of each year.

2. Include the following attributes in the report:

   NOTE: When examining a facility source term, emphasis should be placed on the analysis of job coverage, technical smears, and air sample data in conjunction with an analysis of the amount of radioactive material being handled during work activities.

   - The facility name in the title of the facility source term report
   - Consideration of radionuclides that are most likely to be dispersed in an incident (i.e., contamination that is re-suspendable is more important for routine bioassay planning

than material that is fixed and unlikely to contribute to a worker intake)

- Discussion on the use of air sample analysis and technical smears of material likely to be re-suspended

NOTE: For the context of this procedure, reference to the internal dosimetry technical basis document pertains to information contained in current versions of either MSA-PNL MA 860 or HNF-55719.

- Consideration of the guidance contained in the internal dosimetry technical basis documentation
- Application of guidance found in Attachment A of this procedure
- Process flowcharts, waste characterization data from the Tank Waste Information Network System (TWINS), or other available documents, as applicable
- Routine bioassays that are required for standard work activities
- Exceptions to the bioassay criteria for standard work activities.

3. Submit the completed source term report to the Internal and External Dosimetry CTA for technical review and concurrence.
4. Obtain document approval from the project radiological control manager.
5. Send the approved report to the Internal and External Dosimetry CTA and to RSS Internal Dosimetry for ultimate archiving in RSS's dosimetry records history file.

4.9 Radiological Work Permits

RWP Preparers

1. Follow the guidance of Attachment A for assigning bioassay requirements.
2. Contact the appropriate Internal and External Dosimetry FPOC for assistance in interpretation of unusual circumstances.

Internal and External Dosimetry FPOC

3. Review RWPs annually for bioassay requirement consistency with the source term report and the guidance of Attachment A.

5.0 DEFINITIONS

In vitro bioassay. An indirect measurement of radioactivity on an excreta sample submitted by a worker.

In vivo bioassay. A direct measurement of radioactivity in the body (e.g., whole body count or chest count).

WB. A direct measurement of radioactivity in the body using a three-minute standup whole body count.

WC. A direct measurement of radioactivity in the body using a ten-minute coaxial count.

6.0 RECORDS

The following records are generated during the performance of this procedure:

- Facility Source Term Reports.
- Tank Operations Contractor Dosimetry Change Request (A-6004-105)
- Tank Operations Contractor – "Contractor Request" Bioassay (A-6003-970).

Records that are generated during the performance of this procedure shall be submitted to an approved RadCon Record Storage Area.

The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM_IRM-DC-C-02.

7.0 SOURCES

7.1 Requirements

7.1.1 HNF-5183, "Tank Farm Radiological Control Manual (TFRCM)."

7.2 References

7.2.1 HNF-55719, "Hanford Internal Dosimetry Project Manual."

7.2.2 MSA-PNL-MA-860, "Methods and Models of the Hanford Internal Dosimetry Program."

7.2.3 RPP-44100, "Tank Operating Contractor Internal Dosimetry Technical Basis Document."

7.2.4 TFC-BSM-AD-C-03, "Correspondence Preparation and Control."

7.2.5 TFC-BSM-IRM_DC-C-02, "Records Management."

7.2.6 TFC-ESHQ-RP_DOS-C-06, "Declaring Personal Pregnancy."

ATTACHMENT A - SUPPLEMENTAL INFORMATION GUIDANCE FOR ASSIGNING BIOASSAY REQUIREMENTS IN RADIOLOGICAL WORK PERMITS

Visit/Tour/Inspection Radiological Work Permits (RWPs)

Routine bioassay is not intended for occasional observation, unrelated work in the same room, or other activities involving much less risk of contamination. Visit/inspection/tour RWPs should address hands-off, low-risk access with no bioassay requirements.

Factors to Consider when Assigning Bioassay Requirements

The following identifies when routine bioassays are typically required in RWPs:

- To meet the bioassay specifications of the facility source term report
- Work involves the use of respiratory protection devices and involves actually working with, or in contact with, radioactive material
- Work occurring in a high contamination area (≥100 times Table 2-2 of HNF-5183) that involves contact with, or disturbance of, the contamination
- Work with unencapsulated radioactive material at or exceeding values in RPP-44100, Table 1, "Activity of Radioactive Material Triggering Bioassay Monitoring (normal liquids)"
- Work with unencapsulated radioactive material at or exceeding values in RPP-44100, Table 2, "Activity of Radioactive Material Triggering Bioassay Monitoring (Powders)"
- Work with contaminated soil at or exceeding values listed in RPP-44100, Table 3, "Tank Farms Criteria for Considering Bioassay Monitoring for Work Involving Exposure to Contaminated Soil"
- Exposure to low-level airborne activity that is below posting requirements; e.g., the total exposure for the year would exceed 40 DAC-hour.

Minimum Bioassay Requirements

When a bioassay is required, use Table A-1 to assign the appropriate type of bioassay on RWPs.

- When Cs-137 is part of the radionuclide mixture, use bioassay selection methods that use Cs-137 as an indicator for the mixture, when possible.
- When Cs-137 is not part of the radionuclide mixture, it may be necessary to use bioassay selection methods that use Sr-90 as an indicator for the mixture.

ATTACHMENT A - GUIDANCE FOR ASSIGNING BIOASSAY REQUIREMENTS IN RADIOLOGICAL WORK PERMITS (cont.)

Table A-1. Recommended Bioassay Programs.

Radionuclide	Ratios or Form	Type of Bioassay	Frequency
Mixed Fission or Activation Products (Cs-137 used as indicator for mixture)	If Sr-90:Cs 137 ratio ≤ 40:1	WC[1]	Annual
	If Sr-90:Cs-137 ratio > 40:1	WC[1] Strontium Urinalysis[2]	Annual Biennial
	If pure Sr-90	Strontium Urinalysis[3]	Annual
	Other MFP or activation product gamma-emitters	WC[1]	Annual
Plutonium and Plutonium mixtures containing Americium-241 (Cs-137 used as indicator for mixture)	If Cs-137:Pu ratio > 10:1	WC[1]	Annual
	If Cs-137:Pu ratio ≤ 10:1	WC[1] Pu Urinalysis[2]	Annual Annual
Uranium	Highly Soluble	Uranium Urinalysis	Quarterly or End of Assignment
	Less Soluble	Uranium Urinalysis Chest Count	Annual Semi-annual
	Insoluble	Uranium Urinalysis Chest Count	Annual Annual
Tritium	Chronic	Tritium Urinalysis	Monthly. Go to biweekly if annual H-3 dose will likely exceed 100 mrem.
	Acute	Tritium Urinalysis	End-of-assignment for infrequent or short-term (< 1 month) exposure.
Plutonium and Plutonium mixtures containing Americium-241 (Sr-90 used as indicator for mixture)	If Sr-90:Pu ≥ 400:1	StrontiumUrinalysis[2]	Biennial
	If Sr-90:Pu between 100:1 and 400:1	Strontium Urinalysis[2] Pu Urinalysis[2]	Biennial/Annual
	If Sr-90:Pu < 100:1	WC[1] Strontium Urinalysis[2] Pu Urinalysis[2]	Annual Biennial Annual
Other nuclides or past depositions		Contact Internal Dosimetry CTA/FPOC	

[1]WC = Ten-minute coaxial count: a WB (three-minute standup whole body count) can substitute for a WC.

[2]The indicated procedures are assigned annual whole body counts, annual isotopic plutonium urinalysis (IPU) alternating with strontium urinalysis (IPS).

[3]Pure Sr-90 requires annual strontium urinalysis (IPS).